

REMARKS

Status of Claims

Claims 1-5 were pending at the time of the Office action. Claim 1 is currently amended to correct a minor clerical error. Claims 7-8 are new. No new matter is added. Claim 6 was previously cancelled. As such, claims 1-5 and 7-8 are now pending.

Applicant respectfully requests reconsideration of claims 1-5 and consideration of claims 7-8 in view of the foregoing amendments and in view of the reasons that follow.

Claim Objections

Page 2 of the Office action includes several objections to claim 1. Here, several changes were requested by the Examiner.

To obviate the first objection, Applicant has amended claim 1, as requested by the Examiner, to recite “500m_Qhms mm²” rather than “500m_Qhms mm²[.]” (Emphasis added.)

Regarding the second objection, the Examiner requested that a “forward slash” symbol be inserted between the terms “m_Qhms” and “mm².”

Here, it is believed that such an change is not required. As disclosed on page 3 of Applicant’s specification:

The specific area resistance of a transistor is a well known term with the power semiconductor industry and refers to the product of the on resistance of the transistor . . . multiplied by the area of the transistor. It is a figure of merit by which differing transistors may be compared, in respect of the on resistance and the area . . . (Emphasis added.)

As such, it is believed that the requested insertion of a “forward slash” is not required. Therefore, withdrawal of the objection is respectfully requested.

Rejection of Claims 1-5 under 35 U.S.C. 103

On page 2 of the Office action, claims 1-5 were rejected under 35 U.S.C. 103(a) as being unpatentable over Palara ("Palara," US 5,408,124). These rejections are respectfully traversed.

As amended, claim 1 recites, in relevant portions: "A bipolar transistor . . . wherein the transistor has a specific area resistance less than 500mOhms mm²; and wherein said metal layer has a thickness greater than 3μm.

On page 3 of the Office action, it is acknowledged that Palara does not teach either of the features noted above.

However, on page 4 of the Office action, it is contended that "the specification contains no disclosure of either the critical nature of the claimed ranges or any unexpected results arising therefrom."

Applicant respectfully disagrees with the above contention.

On page 4 of the Office action, it is stated that "[w]here patentability is said to be based upon chosen dimensions or upon another variable recited in a claim, the applicant must show that the chosen dimensions are critical."

Here, it is believed that the criticality of the noted features is sufficiently disclosed. As disclosed on page 6 of Applicant's specification:

A bipolar transistor not already optimised for low saturation voltage (i.e. with a specific area resistance greater than about 500 mOhms.mm²) would show no significant improvement to the saturation voltage by thickening the metal contact in accordance with the present invention since the saturation voltage is affected more by the other parameters described above than by the thickness of the metal contacts. (Emphasis added.)

As further disclosed on page 6 of Applicant's specification:

With bipolar transistor designs already optimised for low saturation voltage [i.e., with a specific area resistance less than 500 mOhms.mm²] increasing the thickness of the metal contacts further reduces the saturation voltage. This reduction in saturation voltage is progressive and proportional to the thickness of the metal contact and track. Significant improvements to the saturation voltage have been observed with a metal thickness of between 4 μ m and 6 μ m, with 6 μ m, the preferable thickness, reducing the saturation voltage of a bipolar transistor optimised for low saturation performance by up to a further 30%. (Emphasis added.)

As such, it is believed that the criticality of the noted features is sufficiently disclosed.

Because the importance of the noted features is sufficiently disclosed and because the Office action provided no additional bases for the rejection under 35 U.S.C. 103, it is respectfully submitted that a *prima facie* case of obviousness has not been made. Therefore, it would not have been obvious for one of ordinary skill in the art to arrive at the invention claimed in claim 1 based on the teachings of Palara.

At least for the reasons explained above, it is believed that claim 1 is not unpatentable over Palara.

Claims 2-5 depend from claim 1. At least for this reason, it is believed that claims 2-5 are not unpatentable over Palara.

New Claims 7-8

New claims 7-8 also depend from claim 1. At least for this reason, it is believed that claims 7-8 are not unpatentable over Palara.

Further, claim 7 recites: ". . . wherein an increase in the thickness of the metal layer corresponds to a reduction in a voltage drop in the contacts to said base and emitter regions." (Emphasis added.)

Further, claim 8 recites: “. . . wherein the reduction in the voltage drop is proportional to the increase in the thickness of the metal layer.”

Support for the above limitations can be found, for example, in pages 5-6 of Applicant’s specification, which discloses:

The thickness of the metal layer defining the base contacts 6 and emitter contacts 7 is chosen in order to help ensure more even biasing of the emitter region 4/base region 3 to reduce the parasitic voltage drop across the emitter metal contacts 7. Reducing the voltage drop in the tracks leading to the diverse base region contacts ensures that the voltage bias applied to the emitter / base junction is more evenly distributed, this ensures more even current density across the transistor, reducing the saturation resistance.

...

With bipolar transistor designs already optimised for low saturation voltage increasing the thickness of the metal contacts further reduces the saturation voltage. This reduction in saturation voltage is progressive and proportional to the thickness of the metal contact and track . . . (Emphasis added.)

Palara teaches away from the noted limitation.

Palara is directed to “provid[ing] the power transistor with a good margin of safety against secondary breakdown (‘safe operating area’)[.]” (Col. 2, lines 59-61.) To this extent, Palara teaches that “the emitter fingers of the power transistor should be fairly wide so that the ballast resistances that are formed in the connection areas between the emitter contact areas and the fingers themselves allow a good balance of the currents in the various fingers of the emitter.” (Col. 2, lines 61-66.) (Emphasis added.) As such, Palara is directed to “mak[ing] an emitter with a high perimeter . . . without reducing the series resistance of each finger of the emitter, that is the ballast resistance, below the value required for making the current distribution uniform in the different fingers of the power transistor.” (Col. 3, lines 48-55.) (Emphasis added.)

In FIG. 2 of Palara, the ballast resistance R_V is shown. As shown in FIG. 2, the ballast resistance R_V is located in the horizontal connection 12 and the vertical connection area 11

leading from the metallization 8 to the emitter region 6. With regards to the ballast resistance Rv, Palara discloses:

... replacing each vertical connection area 7 [see FIG. 1] with a pair of vertical connection areas 11 connected at the surface by a horizontal connection area 12 of the type N+ of a length such as to allow the opening of emitter contact.

In this way a parallel resistance is created, constituting a ballast resistance Rv, which starting from the metallization 8 corresponding to a respective emitter region 6 runs parallel to the surface along a semi-region of horizontal connection 12 and then in depth along a corresponding vertical connection area 11. (Col. 5, lines 10-20.) (Emphasis added)

As such, Palara teaches creating a ballast resistance Rv, which would increase the level of resistance in the horizontal connection 12 and the vertical connection area 11. Accordingly, Palara teaches increasing a voltage drop leading to the emitter region 6.

Therefore, Palara teaches away from “[a] bipolar transistor . . . wherein an increase in the thickness of the metal layer corresponds to a reduction in a voltage drop in the contacts to said base and emitter regions[,]” as recited in claim 7.

At least for the reasons explained, it is believed that claims 7-8 are patentable over Palara.

Conclusion

Applicant believes that the present application is now in condition for allowance. Favorable reconsideration of the application as amended is respectfully requested.

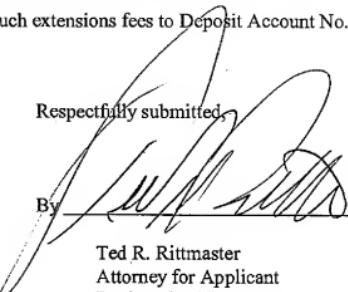
The Examiner is invited to contact the undersigned by telephone if it is felt that a telephone interview would advance the prosecution of the present application.

The Commissioner is hereby authorized to charge any additional fees which may be required regarding this application under 37 C.F.R. §§ 1.16-1.17, or credit any overpayment, to Deposit Account No. 19-0741. Should no proper payment be enclosed herewith, as by a check or credit card payment form being in the wrong amount, unsigned, post-dated, otherwise improper

or informal or even entirely missing, the Commissioner is authorized to charge the unpaid amount to Deposit Account No. 19-0741. If any extensions of time are needed for timely acceptance of papers submitted herewith, Applicant hereby petitions for such extension under 37 C.F.R. §1.136 and authorizes payment of any such extensions fees to Deposit Account No. 19-0741.

Respectfully submitted,

By


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